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The Incidence of Xerophthalmia and Night-Blindness in the United States— A Gauge of Vitamin A Deficiency

ALFRED F. HESS, M.D., AND DANIEL B. KIRBY, M.D.
New York, N. Y.

ALTHOUGH we have acquired a considerable fund of knowledge in regard to the vitamins and collected satisfactory data as to their distribution among the various foods, the question is still mooted as to whether there is a sufficiency of these essential food factors in the American dietary. This question is particularly acute in regard to the adequacy of vitamin A in the diet of both children and adults. In view of the importance of this subject and what we believe to be an exceptional opportunity for its elucidation, we decided to carry out a survey of the clinical evidence of early vitamin A deficiency in cities of the various sections of the country.

As is well known, a lack of vitamin A, which has unfortunately been given the titles "the ophthalmic vitamin," "the growth vitamin" or "the anti-infective vitamin," is manifested in young children and infants by a pathologic lesion of the eye which, according to the degree of severity, is designated as xerosis or xerophthalmia. In adults, we are exceptionally fortunate in being able to recognize the deficiency of this vitamin by the occurrence of a disturbance which is functional rather than organic, namely, night-blindness or nyctalopia. This defect of vision is evidenced by inability to see at night, due to the failure of dark adaptation of the retina; the

affected person may simply note a slight dimness of vision or the lack of vision may be extreme so that he is unable to find his way about even in moderate darkness. In order to ascertain the incidence of these two deficiency manifestations a questionnaire was sent to some 50 leading ophthalmologists in the United States, based on membership in the American Ophthalmological Society, inquiring how often they had encountered moderate or severe cases of xerophthalmia or cases of night-blindness in the course of their private practices. Information was also asked in regard to whether cases of this kind had become more frequent in the course of the current economic depression. Forty-one eye specialists have been kind enough to answer our queries and it is on the basis of such information that we have prepared this short report.

Of the 41 physicians, distributed from the east to the west coast and from Maine to Florida, 11 had not met with cases of xerophthalmia. Most reported having seen but 1 or 2 cases and stated that they regarded the disease as rare. Only 1 is of the opinion that "mild cases are not very rare," adding: "No survey is available at the present time on the incidence of xerophthalmia in this country. As a matter of fact, there are only 12 cases reported in the American literature on this subject. In

RESPONSES OF OPHTHALMOLOGISTS IN REGARD TO INCIDENCE OF XEROPHTHALMIA
AND OF NIGHT-BLINDNESS

Observer	Xerophthalmia		Night-Blindness	Effect of Depression	Remarks
	Moderate	Severe			
1	Not very rare	4 (babies)	0	Fewer than ever	
2	Very few	Very few	0	No increase	
3	Few	2	2	No increase	
4	No answer	1	0	No increase	
5	No answer	0	0	No increase	
6	No answer	0	0	No increase	
7	No answer	1	0	No increase	
8	No answer	2	0	No increase	Seen 10 years ago
9	No answer	0	0	No increase	
10	No answer	?	0	No increase	
11	2	1	0	No increase	
12	No answer	1	1	No increase	
13	No answer	2	0	No increase	Both dieted
14	1	No answer	0	No increase	
15	0	0	0	No increase	Formerly frequent
16	No answer	5	No answer	?	
17	0	0	No answer	0	Five seen in 15 years. Mild cases frequent(?) Frequent in China
18	Rare	Rare	0	0	
19	0	0	0	0	
20	0	0	0	0	
21	0	0	0	0	
22	?	0	0	0	
23	0	0	0	0	
24	0	0	0	0	
25	No answer	No answer	0	0	
26	No answer	2 or 3	0	0	
27	No answer	2	No answer	No answer	Two in 5 years
28	No answer	4	No answer	No answer	Four in 5 years
29	No answer	1	No answer	No answer	
30	No answer	0	No answer	No answer	Large number in negroes years ago
31	No answer	0	No answer	No answer	
32	0	0	1	0	Many cases years ago
33	0	0	0	0	
34	0	0	0	0	
35	0	0	0	0	
36	Rare	Rare	0	0	Some years ago
37	Yes	No	0	?	
38	No	10	0	0	
39	No	Rare	No answer	No answer	
40	No answer	3	3	No answer	Three in 2 years
41	No	2	0	0	Two in 1 year

our community my attention has been called to 5 cases of xerophthalmia in the last 15 years." This was the greatest

number anyone had observed. One wrote, "I have had only 1 case in my practice. This man ate practically

nothing but potatoes." References to a marked restriction of the dietary due to some gastrointestinal disorder or to faddism, were not infrequent. All in all, there is unanimity as to the infrequency of xerophthalmia.

Although cases of xerophthalmia had been reported from time to time, it was not until the period of the World War that this disorder was thrust upon our attention. During the war Denmark exported most of her butter and fed her infants and young children milk which had been skimmed. Before long a disease of the eyes developed among the young. In the 86 cases reported by Bloch,¹ 47 developed this disorder during the first year of life and 20 of these during the first six months. Of Blegvad's² 430 cases of keratomalacia, 368 occurred during the first year, the majority in the second quarter; 62 were seen during the second year of life. These figures indicate the marked susceptibility of infants to this disease and, incidentally, their exceptionally high requirement of this vitamin. Among a group of children given whole milk, Bloch found that no instance of eye disease developed. In general, this has been the experience where xerophthalmia has been noted; in fact, no one has reported its development on an average dietary in a normal child. In almost every instance the diet has been exceptionally and preëminently defective. For example, Pillat,³ who has contributed so greatly to our knowledge of this subject, and has reported its frequency in China among the soldiers, states that they ate "only rice, corn, millet, very little flour; once a month a small quantity of meat and no green vegetables whatsoever. Almost no fat was used for cooking." A similar comment has been made in a recent account of xerosis in Tientsin where the diet of the infants consisted of rice water or condensed milk, and that of the adults of bread, rice or

vegetable water and salted cabbage or turnips.⁴ Probably the condensed milk was given greatly diluted. Aykroyd,⁵ who has published an interesting account of the development of xerophthalmia among the fishermen in Labrador, states that their diet consisted mainly of white bread, molasses, fresh cod fish, salt meat, beans, peas, some potatoes, but no milk, butter, eggs or green vegetables.

In regard to the effect of the economic depression on the incidence of xerophthalmia, the answers, without exception, were to the effect that this condition had not brought about a noticeable increase. Gifford, of Chicago, who has reported cases of xerophthalmia, wrote: "I have really seen very little of this disorder in spite of the depression and I have been on the watch for it." Bedell, of Albany, who has also contributed to the literature on this subject, answered as follows: "Strangely enough I am seeing fewer of these cases at this time than ever, so that the depression has not had any effect in increasing their incidence." This evidence from those who would be expected to see cases of this description is substantiated by the fact that in the Quarterly Index of medical literature for the latter half of 1932, no instance of xerophthalmia is reported from the United States. Although references to night-blindness have been recorded in previous volumes of the Quarterly Index, this disorder is entirely omitted from the latest volume.

The other clinical evidence of a deficiency of vitamin A, night-blindness, can be elicited only in older children or in adults. This sign gains added significance from the fact that it is functional, unaccompanied by ophthalmoscopic evidence, and that it is quickly, almost miraculously, remedied when the dietary is fortified with vitamin A. For example, 1 or 2 teaspoonfuls of cod liver oil will often cure

the condition from a functional standpoint within 24-48 hours. In this symptom we possess the most delicate of all indicators for vitamin deficiency; in relation to no similar disorder have we as yet a sign or test which is unaccompanied by pathologic change. Among the 41 answers only 8 cases of night-blindness were reported by the various specialists, 1 writing that he had met with 3 instances in the past 2 years. That night-blindness is due to a lack of vitamin A was proved in 1925 by the interesting experiments of Fridericia and Holm,⁶ who showed that the visual purple of the retina, after exposure to strong sunlight, was particularly slow to regenerate in rats which had been on a diet devoid of vitamin A. The biologic experiments of Yudkin and his coworkers⁷ indicate that the retina is exceedingly rich in vitamin A. Indeed Yudkin found, according to a later report,⁸ that the retina of the hog is richer in vitamin A than is butter-fat, although the choroidal tissue is almost devoid of it. It may be stated without fear of controversy, that night-blindness is a rare disorder in the United States and that most of the reports of this disturbance emanate from countries where there has been famine or a marked deficiency of food. Without entering into detail, it may be stated that a review of those cases which have been reported from the United States and Europe shows that, as in the case of xerophthalmia, they have been occasioned by either a notable defect in diet due to idiosyncrasy or by some condition which induced a lack of utilization of the food. Drunkards are especially susceptible. A report of the Copenhagen Poor Law Institution states that 45 per cent of the 312 inmates were found to suffer from

night-blindness and that this disorder followed the consumption of corn brandy.⁹

CONCLUSION

A formal inquiry carried out among the leading eye specialists throughout the United States may be summarized by the statement that xerophthalmia is of rare occurrence in this country and that night-blindness is even more exceptional. Furthermore, it is the consensus of opinion that there is no indication whatsoever that either of these diseases has increased in frequency during the economic depression. As both of these disorders are the result of a deficiency of vitamin A, it would seem as if a lack of this vitamin among the child and adult populations is extremely uncommon. This conclusion is all the more warranted in view of the fact that night-blindness is a very early and purely subjective symptom of vitamin A deficiency, occurring before any ophthalmoscopic evidence or microscopic lesion can be noted in the retina.

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23	0	0	0	0	
24	0	0	0	0	
25	No answer	No answer	0	0	Five cases in 30 years
26	No answer	2 or 3	0	0	
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28	No answer	4	No answer	No answer	Four in 5 years
29	No answer	1	No answer	No answer	
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